NOTE ON THE PROBABLE GEOGRAPHICAL DISTRIBUTION OF A SPIDER BY THE TRADE WINDS.

By Rev. Henry C. McCook.

While examining and classifying the collection of spiders in the Academy of Natural Sciences of Philadelphia, I discovered a number of specimens of the large laterigrade *Sarotes venatorius*, Linn., from various localities, as represented upon the accompanying tables and chart (Fig. 1). Starting with the specimens in my private collection, the line of distribution was traced from Santa Cruz, Virgin Isles, to Cuba, to Florida, across Central America, Yucatan and Mexico, across the Pacific Ocean by way of Sandwich Islands, Japan, and Loo-Choo Islands, and thence across the continents of Asia and Africa to Liberia. The line thus indicated extends from the extreme eastern limit of North America to the extreme western coast of Africa, thus girdling the globe, with the exception of 54° of longitude. This excepted area expresses substantially the width of the Atlantic Ocean.

It occurred to me when this fact became apparent, that this line of distribution is within the belt of the North Trade Winds; and further, that there might be some connection between the two facts and the fact that the laterigrade spiders, to which group this animal belongs, are among those which are most addicted, in the earlier stages of growth, to the interesting habit of migrating from point to point. This is done by means of fine threads, emitted from the spinnerets in sufficient bulk to overcome the specific gravity of the body. In other words, they belong to the ballooning species.[1] The suggestion which thus arose led me to refer to a competent authority as to the general course and limits of the North Trades. These are roughly indicated in the chart, Fig. 1, by the two upper lines of arrows, marked (at the ends) *A A* and *B B*. In the Atlantic Ocean the North Trade Winds prevail between latitude 9° N. and 30° N.; in the Pacific between 9° N. and 26° N. We now may turn to the chart in which the following geographical points (shown by a *dot* and *figures*) are represented by our spider. The specimens which have been examined, in the

[1] For some observations of this habit, in full, see an article, by the writer, in Proceedings of the Academy of Nat. Sci., Philadelphia, 1877, p. 308.

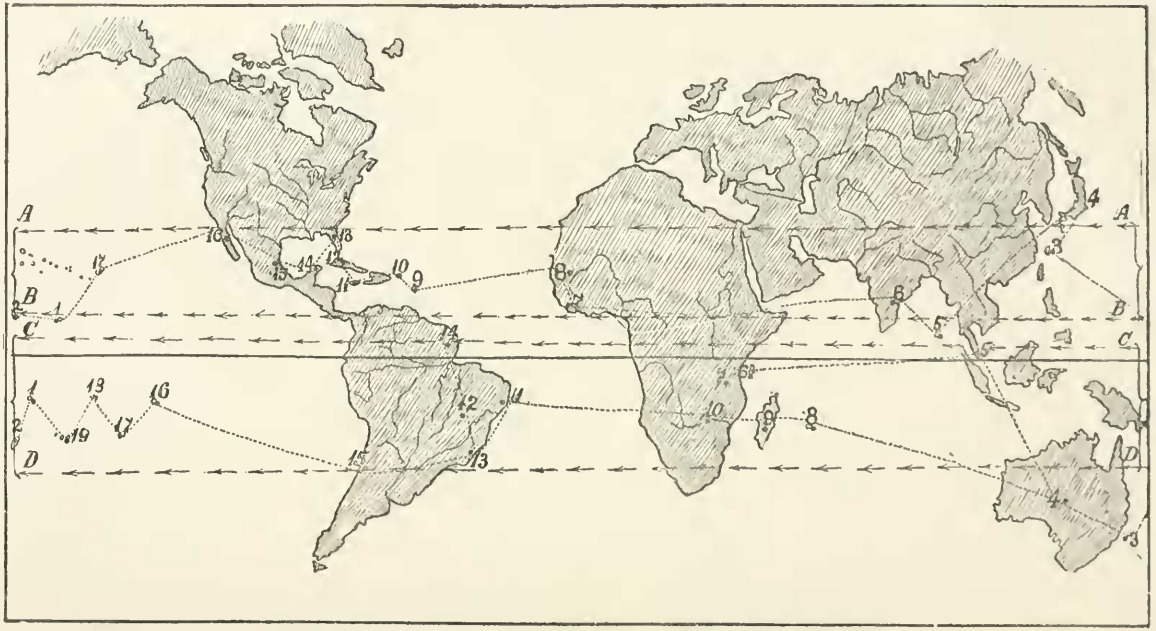
Academy and my own collections, whose habitats are personally known, are marked by an asterisk (*). The species is credited to the other localities named on the authorities given therewith.

A comparison of this table with the chart will at once show that the dotted lines in the latter, which indicate the limits of the geographical belt over which (so far as the specimens in hand and described can determine) *Sarotes venatorius* is distributed, correspond, with remarkable general exactitude, with the belt over which the North Trades blow. It is not, therefore, an improbable conjecture that this distribution has been accomplished by means of those winds and the habit of aerial flight above referred to. It is, of course, supposable that commerce, following largely the same belt, may have originated or aided this distribution. But it is hardly necessary to resort to this hypothesis, when there is one quite as probable, and wholly natural, and operative *before* the general diffusion of inter-continental communication by ships. This last-named condition the facts in the history of the spider seem to require.

Some of these facts are, (1) the early discovery of the species as already widely distributed; (2) its presence at so many different insular points nearly or altogether contemporaneous with their first visits by commercial nations; (3) the existence of the species or its close allies among the fauna of the tropical interiors of continents far distant from coast lines; (4) and finally the variations, chiefly in color, which have been observed, and which would seem to require for their development a longer period than that which has transpired since the commencement of commercial communication with the localities in which the variations have been wrought. While one may not conclude with absolute certainty from these facts, they certainly warrant the theory that the Huntsman (*venatorius*) spider has become cosmopolitan by the action of nature independent of the aid of man.

I was so impressed by the above chain of facts, and so confident of the inference therefrom, that I ventured to predict that corresponding results would follow a comparison of specimens collected from all other quarters; that is to say, they would be found to lie within the belt of the North or South Trade Winds. The only specimens at hand were those cited above, and from Zululand and Surinam. But I was enabled to pursue the matter fur-

Fig. 1.—*Chart of Distribution of Sarotes venatorius.*



A A, *B B*, belt of North Trades. *C C*, *D D*, belt of South Trades.

ther by reference to the locations of various specimens given in the descriptions of a number of naturalists. I was greatly aided in this by references kindly sent me by Mr. Wm. Holden. Some of the localities thus obtained have been tabulated above, and others were found to correspond with the points represented by specimens examined. So far then the conjecture was verified.

The two lower arrow lines in the chart, *C C* and *D D*, give a general view of the course and limits of the South Trades, which prevail in the Atlantic Ocean between latitude 4° N. and 22° S., and in the Pacific between latitude 4° N. and 23½° S.[1] It is of course understood that these limits are not stationary, but follow the sun, moving northward from January to June, and southward from July to December; an oscillation which is also indicated in the zone of distribution. They are, however, substantially as above given, and may be compared with the following table, which shows the southern geographical distribution of this species according to the authorities cited therein.

Table of Distribution North of the Equator.

Locality.	Latitude.	Longitude (Gr.).	Authority.
1. Palmyra Island,	6° N.	163° W.	*
2. Pelew Islands,	7°–8° N.	134° E.	L. Koch.
3. Loo-Choo Islands,	25°–29° N.	128° E.	*
4. Japan,	30°–40° N.	130°–140° E.	*
5. Nicobar Islands,	6°–10° N.	96°–97° E.	Böck.
6 Tranquebar, India,	12° N.	80° E.	Fabricius.
7. Liberia, Africa,	5°–9° N.	10° W.	*
8. Senegal, Africa,	17° N.	16° W.	Walckenaer.
9. Martinique, N. America,	15° N.	61° W.	
10. Santa Cruz,	18° N.	65° W.	*
11. Jamaica,	18° N.	77° W.	Walckenaer.
12 Cuba,	20°–23° N.	74°–85° W.	*
13. Florida,	30° N.	81° W.	*
14. Yucatan,	20° N.	82°–91° W.	*
15. Mexico, Jalapa,	20° N.	97° W.	*
16. California,	?	109°–117° W.	L. Koch.
17. Oahu, Sand. Islands,	20° N.	155°–160° W.	*

[1] An error appears in the chart in the location of the southern limit of the South Trades. The arrow line should not run directly westward from Valparaiso, Chili (15), but from a point 10° above it, passing just south of Friendly Isles (19).

Table of Distribution South of the Equator.

Locality.	Latitude.	Longitude (Gr.).	Authority.
1. Viti Levu, Fejee Islands,	16° S.	180° W.	L. Koch.
2. New Caledonia,	20°–22° S.	163°–162° E.	"
3. Sidney, Australia,	33° S.	150° E.	Böck.
4. Australia,	11°–30° S.	105°–115° E.	L. Koch.
5. Singapore,	2° N.	104° E.	Walck.
6. Zanzibar, Africa,	6° S.	40° E.	Gerstaecker.
7. S. E. Equatorial Africa,	10°–20° S. (?)	30°–50° E.	Blackwall.
8. Mauritius,	20° S.	56° E.	Walckenaer.
9. Madagascar,	8°–26° S.	43°–50° E.	Vinson.
10. Zulu-land,	20° S.	28° E.	*
11. Pernambuco,	7° S.	37° W.	
12. Brazil,		37°–70° W.	Simon, Walck.
13. Rio Janeiro,	23° S.	50° W.	Walck.
14. Surinam,	6° N.	55° W.	*
15. Valparaiso, Chili,	33° S.	70° W.	L. Koch.
16. Tahiti, Huaheine, Soc. Is.	18° S.	150° W.	L. Koch.
17. Rarotonga, Cook's Isls.	22° S.	162° W.	"
18. Upolu, Navigator Is.	13½°–14½° S.	168°–173° W.	"
19. Tongatabu, Friendly Is.	20° S.	172°–176° W.	"

This table shows a distribution corresponding with the limits of the South Trades, with, in three cases, viz., Sidney (3), Surinam (14), and Valparaiso (15), a slight oscillation in accord with a fact above stated. Thus was entirely fulfilled the expectation with which I entered upon its preparation. It might with equal confidence be predicted that *Sarotes venatorius* may be found distributed throughout the South Pacific Islands within the same general belt; moreover, that it may be found among the fauna of the chain of small islands between the Sandwich Islands and Asia, viz., Philadelphia, Drake and Massachusetts Islands, Anson and Magellan Archipelagoes; also of the Cape Verde and St. Helena Islands, off the west coast of Africa. These have all doubtless been stations in the line of migration, the latter across the Atlantic Ocean as the Antilles have been; the former across the Pacific, as the Sandwich Islands, Loo-Choo Island, and Japan have been, and as Mauritius and Madagascar Islands have been across the Indian Ocean. Perhaps a more diligent search might even now prove that this cosmopolitan species has already been collected at some of the above points.[1]

[1] It will be observed that the tables show that the missing points in the South Pacific Islands have been actually bridged over. After the presenta-

There seems nothing improbable in the theory suggested to explain the series of facts here presented. There are not, indeed, many recorded observations of the distances to which spiders are carried out to sea in their aeronautic flights. But before a strong, steady wind, or in cases of storms, it is possible that the greatest distances which appear in the tables could be overcome. An observation of Mr. Darwin is the only one in point to which I can refer.[1] At the distance of sixty miles from land, while the Beagle was sailing before a steady, light breeze, the rigging was covered with vast numbers of small spiders with their webs. The little spider, when first coming in contact with the rigging, was always seated upon a single thread. While watching some that were suspended by this filament, the slighest breath of air was found to bear them out of sight. I have observed similar single-threaded "balloons" sailing at a considerable height above the surface of the earth, and know no reason why, with a favorable breeze, they might not have been carried hundreds of miles. That they were carried at least sixty miles, as Mr. Darwin's testimony shows, and that before a light breeze, gives great probability to such a conjecture. It is to be noted, moreover, that the spiders arrested by the Beagle's rigging were evidently moving on when so stopped, and some of them when arrested soon resumed their flight across the main.

The purpose in nature of such a remarkable habit as these well-known facts exhibit is, doubtless, to secure the distribution of species throughout wide regions. The buoyant filament of spider-gossamer serves the tiny arachnid the same good office that is rendered the thistle-seed by the starry rays of down surrounding it.

It may not be without interest, and may, perhaps, have some bearing upon the above theory of distribution, to remark that the genus (or a closely allied genus) to which *Sarotes venatorius* be-

tion of this communication as above, and the preparation of the chart, I received from Mr. Wm. Holden, of Marietta, Ohio, a number of references from Koch's descriptions of Australian spiders, to which I did not have access, which enabled me to verify in this particular also the prediction made. The tables and chart have been corrected in accordance with the facts thus kindly supplied, but the above paragraphs have been permitted to stand as they were originally written and communicated to the Academy.

[1] Voyage of the Beagle, vol. iii. p. 187.

longs is probably one of the oldest known forms of the spider fauna. Thorell[1] places the now existing genus *Heteropoda* (*Oxyopes*, Koch, *Oxypete*, Menge), from which *Sarotes* has been divided, among those which are represented in the amber spiders. This amber is a fossil vegetable resin, which is met with in various brown-coal strata, and is copiously thrown by the waves on the southern coasts of the Baltic, especially the coast of Prussia and the Kurische Haaff. This amber belongs to the tertiary ("oligocene") period, and in it numerous spiders are found, generally well preserved. How far any supposed contiguity or closer approach of continents now separated might have facilitated or occasioned the world-round distribution of our Huntsman spider, is a point upon which geologists may more properly express an opinion.

The question, what variation of species, if any, occurs in the course of this distribution, is of great interest. The specimens examined by me show no variations which may not be accounted for by differences in age, or which may not come within the range of those ordinary natural differences which all animals more or less exhibit. Most of the specimens, however, had been so long in alcohol as to obliterate any differences in color which might have existed. The normal color is a uniform tawny yellow, varied upon the cephalothorax by a circular patch of blackish or blackish-brown color covering nearly two-thirds of the space; and, further, by a white or whitish marginal band quite or nearly girdling the same. In some of the specimens this circular patch seems to have been more or less of a brownish color. The eminent naturalist Gerstaecker[2] speaks of this species as distributed over a large part of Africa, Asia, and South America. Specimens were examined by him from Dafeta, Mombas, and Zanzibar. In these there was some variation in the coloration of the maxillary palpi: on the one hand, from a light rust-color to brownish-red and pitch-brown; on the other hand, to a more or less sharp division or limitation of the light yellow color of the anterior and posterior borders of the cephalothorax. There was also a browning of the region about the eyes. Gerstaecker very justly observes that this indicates that on this sort of differences not as many

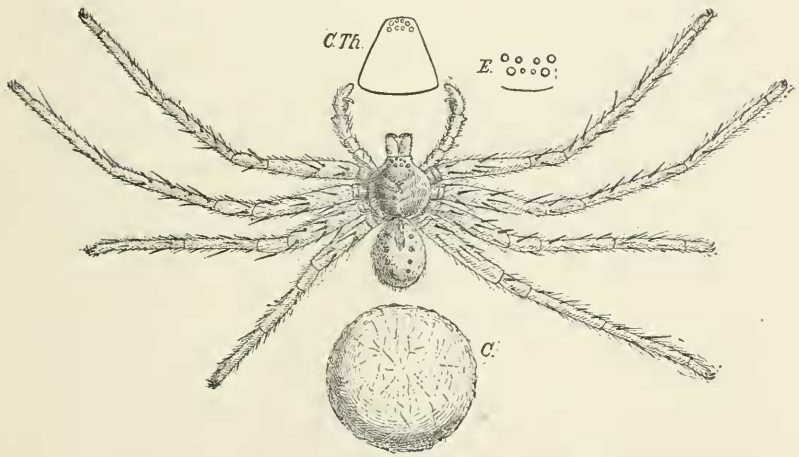
[1] European Spiders. p. 231. Nov. Acta. Reg. Soc. Sci. Upsal. 1870. I have not the work of Koch and Berendt, to which Thorell refers.

[2] Von der Decken's Travels in East Africa, III. ii. p. 482.

specific characters can be established as upon the more stable differences in the relative size of the eyes and legs.

A female, closely resembling the male which is here figured, was sent to me from Vera Cruz (Virgin Isles) by Mr. F. G. Sherman. It was taken in or near the house by one of the colored servants, who (says Mr. S.) handle the spiders readily and with impunity. The *cocoon*, Fig. 2, *C*, was inclosed in the box. It is of a pink color; is drawn about natural size, being over three-fourths of an inch in diameter. Cocoons of the same description were sent me by Mr. Jno. F. Folsom from Cuba, together with a large number of young spiderlings. These had evidently escaped from the cocoon, after immersion in the spirits. They are three-thirty seconds of an inch long; whitish color, with reddish-brown annuli or regular markings upon the legs, and two rows of dots of the same color on each side of the medial line of the abdomen.

Fig. 2.



Saro'es venat rius (natural size). *C.* Cocoon. *E.* Eyes. *C.Th.* Outline of cephalothorax of *S. truncus*.

The male, Fig. 2, was received from Archibald McIntyre, Esq., who brought it from Florida in the winter of 1874–75. It was observed for the space of five or six weeks hanging listlessly to the wall in the angle of the ceiling. It then moulted, moved, and was captured. The length of body is about three-quarters of an inch; the abdomen being somewhat shrivelled, its length is some-

what uncertain. One of the 4th pair of legs is shorter, imperfect, showing that the original leg had been lost in combat or by some accident, and that a new leg had thus far been restored by nature. The fact that both these specimens—the only ones in hand of whose habits I have any account—were found in the house would seem to indicate a fondness for such domicile, that might make more easy the distribution of this species by means of ships. Moreover, Latreille records,[1] as a fact communicated to him, that in certain parts of the tropical regions of the New World, this animal, instead of being looked upon with aversion, as are the most of its order, is regarded with positive pleasure by proprietors of homes, on account of the service rendered in the destruction of cockroaches and other noxious insects. For this purpose the spider is not only preserved, but is introduced within the house. Mr. Holden has information of the same fact in connection with this or an allied species in the Sandwich Islands. It may be said that the general habit of the entire group of laterigrades is, however, quite different from that of house-spiders. They chiefly inhabit trees and shrubbery, upon the leaves or bark of which they lie in wait and seize their prey as from ambush. The spider is probably rare, at least not abundant, in the United States. It has frequently been described in European journals; but, as it has a place among our spider fauna, a description is herewith appended, together with a synonymicon of the most important references.

ARANEÆ.

LATERIGRADÆ.

THOMISOIDÆ.

PHILODROMINÆ.

Sarotes venatorius (Linn.), 1767.

1767. *Aranea venatoria*, Linn., Syst. Nat. (12 ed.) I. ii. p. 1035, No. 33.
1789. *Aranea venatoria*, Linn., Syst. Nat. (13 ed.) I. p. 2960, No. 33.
1793. *Aranea regia*, Fabr., Entom. Syst. II. p. 408, No. 4.
1804. *Heteropoda venatoria*, Latr., Nouv. Dict. d'H. N. (1st ed.) XXIV. p. 135.
1805. *Thomisus leucosius*, Walck., Tabl. d. Ar. p. 36, No. 28, pl. 4, fig. 33.

[1] Nouv. Dictionnaire d'Hist. Nat., ed. 1819, tom. 34, p. 33, art. *Thomise*.

1806. *Thomisus venatorius*, Latr., Gen. Crust. et Ins. I. p. 114.
1806. *Thomisus leucosius*, Latr., Gen. Crust. et Ins. I. p. 113.
1810. *Aranea regia*, Epit. Entom. p. 111.
1829. *Thomisus leucosius*, Latr., Cuvier, Regne Anim. IV. p. 256.
1833. *Sarotes regius*, Sund., Conspect. Arachn. p. 28.
1836. *Thomisus leucosius*, Duges, Regne Anim. Arachn. p. 60.
1837. *Olios leucosius*, Walck., H. N. d. Ins Apt. I. p. 566, No. 5.
1842. " Lucas, H. N. Cr. Ar. et Myr. p. 395, No. 3.
1845. *Ocypete draco*, C. Koch, Die Arachn. XII. p. 44, f. 983.
1850. " C. Koch, Uebersicht, V. p. 37.
1851. *Olios leucojus* (*leucosius*), Böck, Verh. z-b. Ges. Wien, XI. p. 389.
1863 " " Vinson, Ar. Reun. Maur. et Mad. p. 98, No. 3, pl. ii. f. 3.
1864. " " Simon, H. N. d. Araign. p. 410.
1866. " " Blkw., Ann. Mag. Nat. Hist. 3d ser. XVIII. p. 457.
1870. *Heteropoda venatoria*, Thor., On Europ. Spid. p. 178.
1873. *Olios regius*, Gerst., in C. von der Decken, Reisen in Ost. Afr. III. ii. p. 482.
1875. *Sarotes regius*, Koch, Die Ar. Austr. pp. 660, 675, 854, Tab. 56, f. 1, 2.

Length of body, five-eighths inch. Spread of legs, five inches.

Cephalothorax slightly convex, large, broad, broadest through the middle part, rounded on the sides, slightly truncated at the base, very little compressed in front. The caput is but little elevated; is truncated at the face. The color of the spider is a uniform tawny, except upon the cephalothorax, where a broad, brownish, and black band flows down about two-thirds the distance from the medial line to the margin. The margin of the cephalothorax is again of a tawny color, the band running around in front, narrowing toward the face, which it crosses just above the articulation of the falces, the color being whitish on the face. The head and eye-space are touched with black, or are tawny. At the indentation the blackish band divides by a tawny line which follows the cephalic juncture around to the face. The eyes, Fig. 2, *E*, are arranged in two rows of four each, the front row being the shortest. The two central front eyes are the smallest of all, and are placed upon an elevation narrowing towards the front. These are nearer to each other than are the two posterior middle eyes, from which they are separated by a space somewhat larger than that which separates the front eyes and the margin of the face. The lateral front eyes are the largest of all. Viewed from the front they are nearly in a straight line

(subrecta); but viewed from above they are slightly curved backward. The back row of eyes is about equally (perhaps even less) curved backward. They are more nearly equal in size, but the lateral eyes are larger than the middle ones. A whitish line below the eyes joins the face with the falces, which articulate nearly upon a plane with the face. They are conical, covered with bristles, rather blunt at the end, but cut away upward and toward each other. They have about six teeth. Lip is oval, cut squarely at the tip. Maxillæ are gibbous, lean toward the lip slightly, are rounded at the end, scalloped at the middle of the outer edge, tipped with thick tooth-like hairs. Sternum cordate, tawny color, hairy. Palpus of female (Santa Cruz) long; the joints armed with about five strong, short spines each, the terminal joint ending with a thick brush of bristle-like hairs, imbedded within which is a five-toothed claw. The palpus of the male has on the outside of the digital joint a black, double-toothed, or notched, horn-like projection. In the palm of the terminal bulb is a black cushion, from or below the end of which projects a pinkish, spine-like organ. On the end of the radial joint without is a black, corneous projection, curved at the extremity.

Feet, order of length, 2.4.1.3, the difference between 4.1. not very marked.

On the upper part of the thigh (femur) are arranged eight black spines, six in pairs along the upper side; two along the very top, one of these two being in a row with the 2d pair, the other standing alone near the joint of the patella. This last is shorter by about one-half, and bent more than the others. A pair of short and slight spines on the sides of the patella. On the tibia are nine spines, eight arranged in pairs below or on the under sides, the last two near the joint of metatarsus being shorter and bent; the remaining spine is between the 1st and 2d pairs, and above. There are five spines on the metatarsus, three shooting out well together near the joint of the tibia. The under sides of the tarsus and metatarsus are covered with a thick scopula. The claws are two—long, strong, curved toward the end, toothed at the base, apparently the inner claw having more teeth. A pad or brush completely underlies the claws. Abdomen much shrivelled, but evidently oval, tawny, hairy, and marked as nearly as may be as in the figure.

Habitat. Florida.

Sarotes truncus, n. sp.?

In the collection referred to in the above paper was found one specimen which differs so widely from other individuals in the shape of the cephalothorax that it is probably entitled to be classified as a new species. The cephalothorax, Fig. 2, *C. Th*, is truncated at the base, which is the widest part, being three-eighths of an inch wide, which is also the length of the medial line of the cephalothorax. The sternum is an almost regular decagon. The eyes and other parts correspond generally with those of *S. venatorius* as described. The view of the eyes in the figure is from above.

Female. Japan.